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Kyle Jiang

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EXAMINER

CHEA, THORL

ART UNIT

PAPER NUMBER

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/582,033	<b>Applicant(s)</b> JIANG ET AL.	
	<b>Examiner</b> Thorl Chea	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 17 December 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                      |                                                                   |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____                                                          | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

1. This office action is responsive to the communication on December 17, 2009; claims 1-19 are pending.

#### ***Drawings***

2. Figure 4 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to under 37 CFR 1.83(a) because they fail to show the number associated with Figs. 1, 2 such as microengine (10), piston (12), piston cylinder (14), gear wheel (16), connection rod (18) as described in the specification presented on page 6, third paragraph. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief

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description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The specification disclosure fails to use the processing step claimed in the claimed process to produce a component "a reciprocating microengine comprising a cylinder, piston, and crankshaft presented in claim 18. The steps of (i) to (iii) in claims 1, 4 to produce such articles. See for instance the processing step shown on page 8-9 wherein there is no structure shown in Figs 1-2 described on page 6 is produced, or no part thereof has been produced. The whole specification disclosure is related to improve lithographic process such as improving the mechanical strength of a part containing an epoxy rein. The processing steps as claimed cannot produce an article represented by Figs. 1-3. "(w)hen there is exists evidence that a claim does not correspond in scope with what applicant intends to be his invention, a rejection should be made under 35 USC 112, second paragraph in that the claims do not set forth what

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applicant regard as his invention. In re Mayhew 188 USPQ 356 (CCPA 1976); In re Cormany 177 USPQ 450 (CCPA 1973); In re Prater 162 USPQ 541 (CCPA 1969).”

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The use of the term “type” in association with “epoxy-type negative photoresist” in claim 1, 4 is indefinite as it is unclear whether the “type” characterizes the structure, the composition, the physical characteristic of the photoresist, the sensitivity of the photoresist or else. “The word “type”, when appended to an otherwise definite term, may render said term indefinite. Ex parte Attig (“Zeolite-type”) 7 USPQ 2d 1092 (BPAI 1988); Ex Parte Copenhagen 109 USPQ 118 (PO BdPatApp 1955.” . The scope of protective sought for “epoxy-type negative photoresist” is indefinite in view of the specification disclosure. The specification disclosure disclose the use of “SU-8” wherein the “epoxy-type negative photoresist” encompasses the scope beyond “SU-8” and have different utility than preferred in the present specification disclosure. The term “high aspect ratio” present in claim 1, 4, 17, 19 is indefinite for the term "high aspect ratio" or "aspect ratio" is not clearly define in the specification disclosure. See for instance the specification” on page 5 discloses “the above method is suitable for fabricating parts having depth of 1 mm or more with an aspect ratio of 10:1 or greater, and even 40:1 or greater”. There only one dimension shown therein, i.e., depth, and it is unclear with respect to another dimension to get the claimed ratio, called “high aspect ratio”. The claiming of

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the "exposed photoresist" in step (ii), (iii) in claims 1, 4 is indefinite for it is unclear with the antecedent basis thereof. The claiming of the "elevated temperature" in step (i) claim 1, 4 is indefinite as the mete and bound thereof cannot be determined from the specification disclosure.

***Specification***

8. Claim 18 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The invention in claims 1, 4 are related to lithographic process for producing high aspect ratio part, wherein the invention in claim 18 is "a reciprocating engine comprising a cylinder, a piston and crankshaft" wherein the step of producing a cylinder, a piston and a crankshaft is not provided in claims 1, 4.

***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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11. Claims 17-18 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over either Conradie E.H et al or Warren (US 2002/0115016A1). Conradie discloses a part containing SU-8 made by a process having a step similar to that claimed in the present claimed invention. See page 369, Fig.1; page 270, Fig.2; page 372, Fig.6 and the processing step on page 369, second column wherein the prebaked SU-8 is exposed to uv illumination, and post-exposing baking, and then developing in undiluted PGMEA. See also the part taught in Warren in Fig.1.

Conradie or warren may not disclose the use of total energy density of from 18,000 to 35,000 mj/cm<sup>2</sup> presented in claim 1 or at least 20 % of the uv light emitted from the mercury lamp having wavelength 365 nm is filtered out. However, the material claimed in the present claimed invention is related to the claiming of a material by a process, wherein the patentability of the product does not depend on its method of production. “(E)ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same or obvious from a product of prior art, the claim is unpatentable even though the prior art product was made by different process.” In re Thorpe 777 F.2d 695, 698, 227 USPQ 694, 966 (Fed. Cir. 1985). In this case, the material taught in Conradie et al or Warren contains same epoxy and have similar structure including part or cylinder claimed in the present invention such as shown in the Figs. Shown above. In the absence of showing that the process claimed in the present claimed invention produces different or unobvious product, it is asserted the material taught in Conradie et al or Warren is either

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anticipated by or would have been found obvious to the worker of ordinary skill in the art at the time the invention was made.

12. Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Missek et al (US 6,716,568), Ohkubo et al (US 5,118,548), Zhong-geng Ling and applicant's disclosure on pages 1-3.

Missek et al discloses a process substantially as claimed. See negative epoxy resin in column 4, lines 20-55, and the process in column 5, lines 50-65 which provides spin coating process, photoimaged using an exposure tool with near-ultraviolet radiation from medium or high-pressure mercury lamp; post-exposed-baked, and then immerse in an organic solvent in order to dissolve away the un-polymerized region. Ohkubo et al (column 5, lines 20-37) discloses the polymerization of polymer including using a uv ray from a high pressure mercury lamp such that the total quantity is 1.0 to 200 J/cm<sup>2</sup>. Zhong-geng Link. Discloses an improved patterning quality of SU-8 microstructures by optimizing the exposure parameters including the thickness of SU-8, wavelength of uv and exposure dose. See for instance page 1024 which discloses the dimension change vs doses; page 1021, Fig.4, wavelength vs absorption coefficient. The specification disclosure on page 3, discloses "Much to be surprise of the inventor, it was discovered that the high aspect ratio structure could only be obtained by filtering out a portion of the light below 400 nm. This was unexpected since 365 nm light is generally recommended by SU-8 suppliers (the most commonly used epoxy-type negative photoresist) as optimum wavelength for exposure, since this the wavelength at which SU-8 is most sensitive to exposure".

Missek et al may not may not disclose the use of total energy density of from 18,000 to 35,000 mJ/cm<sup>2</sup> presented in claim 1 or at least 20 % of the uv light emitted from the mercury lamp



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having wavelength 365 nm is filtered out in claim 4, but discloses the use of medium or high-pressure mercury lamp which produce uv encompasses the scope of uv used in the present claimed invention. Moreover, the high-pressure mercury lamp has been known to produce the total quantity is 1.0 to 200 j/cm<sup>2</sup>. It has been known to improve the microstructure containing SU-8 in term of thickness, dose of uv and wavelength thereof such as taught in Conradie E.H et al. The specification disclosure discloses that the wavelength of 365 nm is recommended by SU-8 supplier. claim 1 of the present claimed invention encompasses the use of uv wavelength band within the range of higher than 400 nm, and claim 4 encompasses wavelength within uv band, except partial wavelength of 365 nm is used. The uv range claimed in the present claimed invention still encompasses the range that is sensitive to the negative epoxy photoresist. Moreover, it has been known in the art that the high mercury lamp could produce an energy with a density of 18,000 to 35,000 mj/cm<sup>2</sup>. Therefore, it would have been obvious to the worker of ordinary skill in the art to use an high pressure mercury lamp that produce a total quantity of 1.0 to 200 j/cm<sup>2</sup> taught in Ohkubo that is available in the art to expose the negative epoxy resin taught Minsek et al using an optimizing process taught in Zhong-gen Ling, and thereby provide a process as claimed. The percent of at least 20 % of the UV light emitted from the mercury lamp having at least a wavelength of 365 nm is filtered out presented in claim 4 would have been obvious to the worker ordinary skill in the art since the wavelength produced by mercury lamp produces generate wavelength encompasses the scope of wavelength remaining in the spectrum.. The worker of ordinary skill in the art at to use less sensitive wavelength with higher amount of energy to cross-link the negative epoxy resin.

***Response to Arguments***

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13. Applicant's arguments filed on December 17, 2009 have been fully considered but they are not persuasive because of the reason set forth above. The applicants argue that "none of the cited references, whether taken alone or in combination, teach or fairly suggest or describe irradiating a pre-baked masked epoxy-type negative photoresist on a substrate with light at a total energy density from 18,000 to 35,000 mj/cm<sup>2</sup> as described by independent claim 1."; Ohkubo described polymerization from a mercury lamp producing a total light quantity of 1 to 200 J/cm<sup>2</sup>, but this polymerization is not performed on a pre-baked masked epoxy-type photoresist much less a photoresist of any kind, further, that there is no teaching, suggestion, or motivation to combine Ohkubo reference with the other, cited references. Substrate described in Ohkubo is "a polymer containing a specific acrylated-based monomer as an essential component". This type of substrate is totally unrelated to SU-8 processing photoresist, and the like, such that the irradiation parameter described in Ohkubo are irrelevant and unusable for the epoxy type negative photoresist, as described in present claims. The applicants stated that "the rejection under 35 USC 103(a) "should be explicit"; the Examiner must present a convincing line of reasoning supporting a rejection; the rejection of obviousness "cannot be sustained by a mere conclusory statement; there must be some articulated reasoning with some rational underpinning to support legal conclusion of obviousness".

It is the Examiner's position that the invention would have been found prima facie obvious to the worker of ordinary skill in the art at the time the invention was made. The principal issue is the irradiation a pre-baked masked epoxy-type negative photoresist on substrate with light with no more than 15 % of the energy density contributed by light having a wavelength of less than 400 nm or less presented in claim 1 and (i) irradiating a pre-baked masked epoxy-type negative

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photoresist on a substrate with a high pressure mercury lamp that emits ultraviolet (UV) light, wherein at least 20% of the UV light emitted from the mercury lamp having a wavelength of 365nm is filtered out: The other processing steps having commonly known such as shown in the applied prior art of record. The light used in the claimed invention encompasses the uv wavelength produce by high pressure mercury lamp except the wavelength which is most sensitive to SU-8, and the amount more than required by the prior art record and the disclosure in the specification disclosure. The uv light used in Zhong-geng Ling from 240-550 nm (page 1024). The light having wavelength of less than 400 nm or less or 365 nm is not used by the present claimed process. The scope of claim 1 still encompasses the uv wavelength between 400 to 550 nm. Claim 4 includes wavelength form 240-550 nm, except 20 % of the wavelength 350 nm is filtered out. The scope of the wavelength still encompasses the whole scope of uv wavelength taught in the applied prior art of record. The invention in claim 4 is not include the energy density from 18,000 to 35,000 mj/cm<sup>2</sup> presented in claim 1. Therefore the invention in claim 4 is irrelevant to the energy density from 18,000 to 35,000 mj/cm<sup>2</sup>. The invention in claim 4 would have been found prima facie obvious to the worker of ordinary skill in the art since it encompasses the scope of uv length taught in the applied prior art of record. The worker of ordinary skill in the art would have include or exclude wavelength within the uv wavelength including that having wavelength of 365 nm with an expectation of polymerizing the negative type epoxy photoresist since the epoxy type negative photoresist is more or less sensitive within the uv range. Likewise, the wavelength within the range from 400 to 550 nm overlaps the wavelength within the uv wavelength range sensitive to epoxy negative photoresist, and the worker of ordinary skill in the art would have include or exclude wavelength within the uv

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wavelength including that having wavelength of less 400 nm with an expectation of polymerizing the negative type epoxy photoresist since the epoxy type negative photoresist is more or less sensitive within the uv range. The applicants' specification disclosure that the uv having wavelength of 365 nm is generally recommended by SU suppliers (the most commonly used epoxy-type negative photoresist) as the optimum wavelength for exposure, since this is the wavelength at which SU-8 is most sensitive exposure. In this case, the applicants preferred the to use the uv by completely excluding the wavelength of 365 nm or partially filtering out a partial wavelength of 365 nm preferred by recommended by SU suppliers, but use light having wavelength within uv range known to be sensitive to epoxy-type negative photoresist. This selection of wavelength would have been found prima facie obvious to the worker of ordinary skill in the art. Nonpreferred embodiments can be indicative of obviousness. *Merck & Co. v. Biocraft Laboratories Inc.* 10 USPQ 2d 1843 (Fed. Cir. 1989); *In re Lamberti* 192 USPQ 278 (CCPA 1976); *In re Kohler* 177 USPQ 399 (CCPA 1973); *In re Mill* 176 USPQ 196 (CCPA 1972); *In re Bozek* 163 USPQ 545 (CCPA 1969); *In re Meinhardt* 157 USPQ 270 (CCPA 1968); *In re Boe* 148 USPQ 507 (CCPA 1976); *In re Nehrenberg* 126 USPQ 383. In this case, the worker of ordinary skill in the art would have use uv light outside the recommendation of SU-supplier, but within the sensitivity of the epoxy type negative photoresist material. The total energy density of from 18,000 to 35,000 mj/cm<sup>2</sup> presented in claims 1 or 4 would have found prima facie obvious to the worker of ordinary skill in the art at the time the invention was made since the uv light within the range claimed invention is less sensitive than the recommendation of SU-supplier, and the worker of ordinary skill in the art would have expected to use higher energy than the optimum wavelength for exposure. In the absence of showing the criticality

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thereof, it is asserted that the amount of energy as claimed would have been found *prima facie* obvious to the worker of ordinary skill in the art at the time the invention was made. The selection of appropriate relative proportions or optimization of relative proportions would have been obvious to one of ordinary skill in the art. See In re Luck 177 USPQ 523 and In re Boesch 205 USPQ 215. In this case, It would have been obvious to select a light in which less sensitive to epoxy negative photoresist with higher density of energy with expectation of success.

Ohkubo et al (US 5,118,548) my not discloses the use of to exposed the pre-baked masked epoxy-type negative photoresist presented in the claimed invention. However, the use of Ohkubo et al (US 5,118,548) reference is to show that the high pressure mercury lamp could provide a total quantity is 1.0 to 200 j/cm<sup>2</sup> (1000 to 200,000 mj/cm<sup>2</sup>), and the worker of ordinary skill in the art would have use any known high pressure mercury lamp that could produce the amount of energy including within the range as claimed to polymerize the known epoxy-type negative photoresist material. “the selection of something based on its known suitability for its intended use has been help to support a *prima facie* case of obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327,65 USPQ 297 (1945). See 2144.07.

The applicants argue that applicants point out that the claimed lithographic process enable processing of high-thickness photoresist (e.g. 0.701 mm to 1.5 mm) to produce high aspect ratio parts (e.g. 10:1 or even 40:1) as described in claim 10, 17, 19 etc...

Claims 1, 4 art not related to the claiming of the thickness 0.701 mm to 1.5 mm. The aspect ration presented in claims 17, 19 is relative term, and fails to differentialte the claimed material in view of prior art. The thickness of 0.701 mm to 1.5 mm may not specifically disclosed in the applied prior art, however, the thickness would have been found *prima facie* obvious to the

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worker of ordinary skill in the art. Changes in size, dimension, shape, proportion, or mere duplication of parts, are not sufficient to patentably distinguish over the prior art, unless the recited changes are critical, i.e., they produce a new and unexpected result which is different in kind and not merely in degree from the result of the prior art. In re Rinehart, 531 F.2d 1048, 189 USPQ 143. See also In re Dailey, 357 F.2d 669, 149 USPQ 47. See also In re Harza, 274 F.2d 669, 124 USPQ 378; MPEP 2144.04 IV-VI. Moreover, it would have obvious to provide higher amount of irradiation while the thickness when a thicker the epoxy photoresist in order to provide complete cross-linking of the photoresist.

### ***Conclusion***

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thorl Chea whose telephone number is (571) 272-1328. The examiner can normally be reached on 9 AM-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia H. Kelly can be reached on (571)272-1526. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would

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like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TC/

March 12, 2010

/Thorl Chea/

Primary Examiner, Art Unit 1795